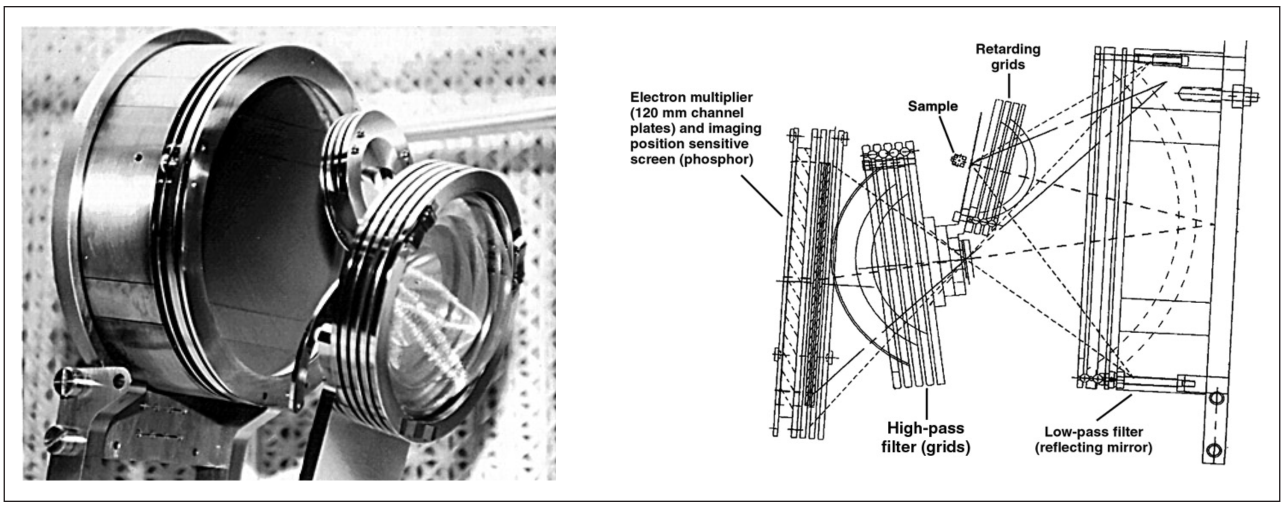
# Ellipsoidal Mirror Electron Energy Analyzer (EMA) • Beamline 8.0.1

Berkeley Lab • University of California

## Enstation Specifications

| Kinetic Energy Range (eV) | Energy Resolution (meV) | Spot Size (μm) | Angular Data Set Time (s) | Samples | Availability |
|---|---|---|---|---|---|
| ≤ 900 | 80 | 100 | 30 (typical) | UHV-Compatible Solids (up to 2.5 × 1 cm$^2$) | NOW |




***EMA photograph** (left) and schematic (right) of major components.*

Beamline 8.0.1 serves two permanently placed, PRT-owned experimental stations for x-ray absorption and photoelectron spectroscopy and imaging of materials and surfaces. The ellipsoidal mirror electron energy analyzer (EMA) station is owned by the University of Wisconsin-Madison and the Lawerence Livermore National Laboratory. It is designed for high energy and angular resolution with rapid throughput. A separate data sheet describes a soft x-ray fluorescence (SXF) spectro-meter that shares beamtime with EMA by means of a movable platform and a flexible bellows.

An ellipsoidal horizontal and vertical refocusing mirror generates a 100-μm spot at the sample position. The EMA station features a wide-area detector that facilitates rapid collection of large quantities of data. This detector images photoelectrons emitted within an 84-degree cone around the sample normal onto a channel-plate detector, preserves angular information, and offers energy selectivity with a resolution of 80 meV. By simultaneously recording isoenergetic electrons emerging in different directions, the EMA can generate angle-resolved data sets in about 30 seconds each.

A UHV sample chamber accommodates solid samples up to 2.5 × 1 cm$^2$. *In-situ* sample preparation capabilities in the main chamber include resistive heating, ion sputtering, and evaporation. There is

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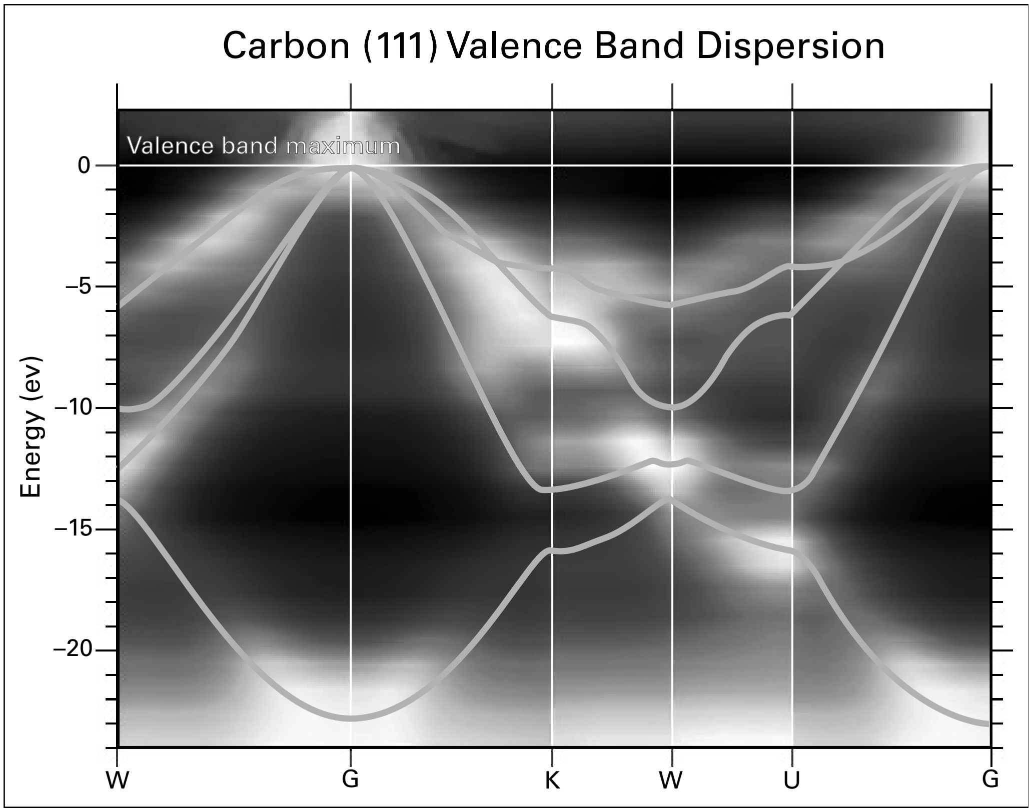
also a UHV sample-storage/preparation chamber with in-vacuum transfer to the sample chamber.

Typical experiments performed in the station are based on x-ray photoelectron spectroscopy (XPS), angle-resolved photoelectron spectroscopy (ARPES), and near-edge x-ray absorption fine-structure spectroscopy (NEXAFS). Specific examples include valence-band and Fermi-surface mapping, core level shifts between surface and bulk atoms, and investigations of the electronic structure of organic films. ■




***Band structure for carbon (111), obtained using angle-resolved photoemission.*** *The calculated band structure is shown as solid lines; the angle-resolved photoelectron spectroscopy data is shown in shades of dark and light, with lighter shades representing higher detected electron intensities. The horizontal axis shows crystal momentum, indexed by letters representing points of symmetry in the band structure. The experimental and theoretical data shown here are in excellent agreement for the characteristics modeled by theoretical quasi-particle calculations. The fuzziness of the experimental data is due to lifetime broadening, experimental resolution, and other effects that are not yet fully modeled in quasi-particle band calculations. Data courtesy of I. Jiménez, L.J. Terminello, D.G.J. Sutherland, and J.A. Carlisle (Lawrence Livermore National Laboratory); E.L. Shirley (National Institute of Standards and Technology); and F.J. Himpsel (University of Wisconsin-Madison).*

To obtain a proposal form, go to www-als.lbl.gov/als/quickguide/independinvest.html.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